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GILBERT ASSOCIATES INC READING PA
NATIONAL DAM SAFETY PROGRAM, FALLS MILLS DAM (VA 18503), TENNES--ETC(U)
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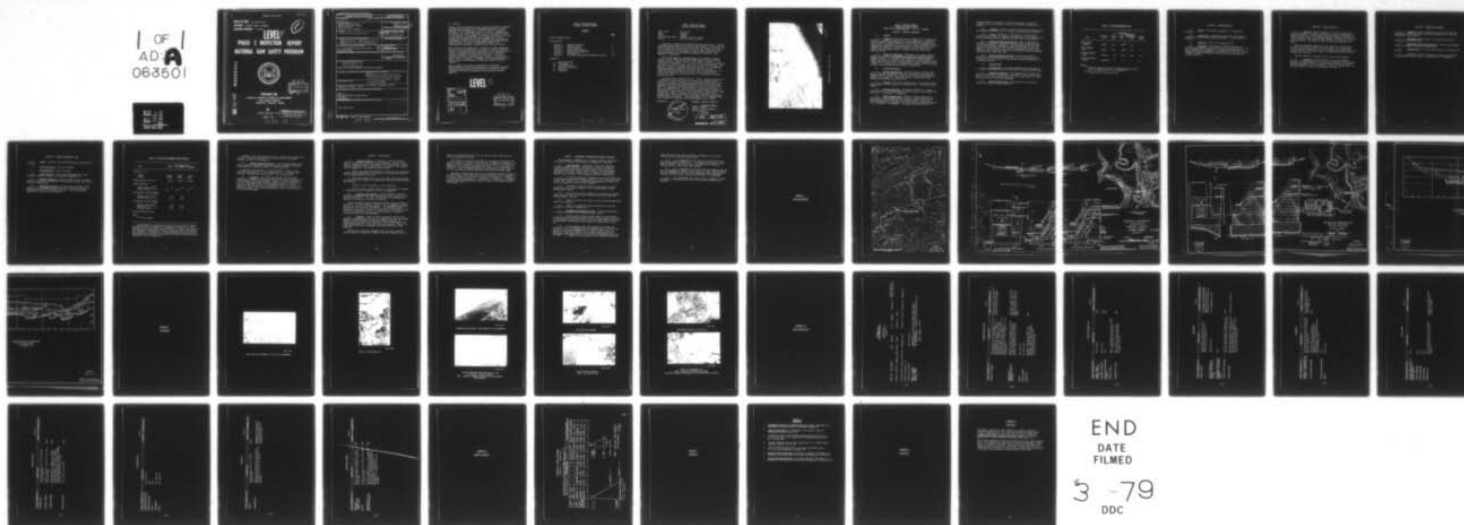
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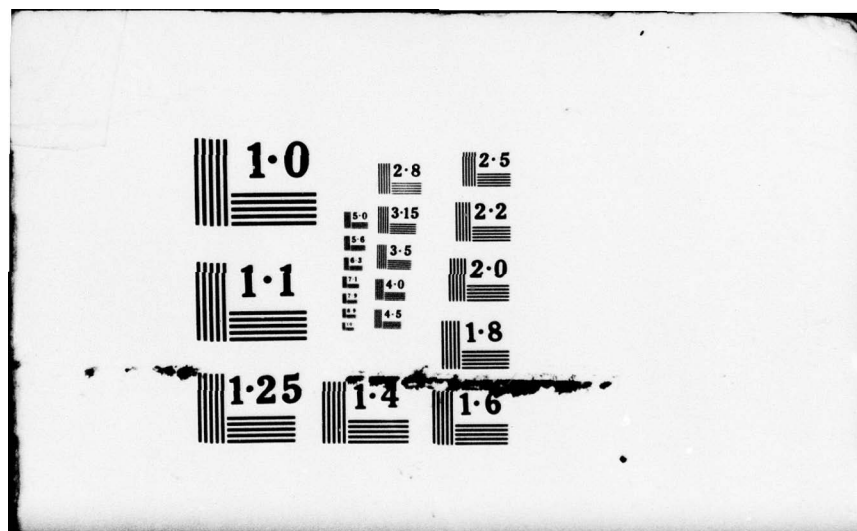
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AD-A
063501





Name Of Dam: FALLS MILLS DAM

Location: TAZEWELL COUNTY, VIRGINIA

Inventory Number: VA 18503

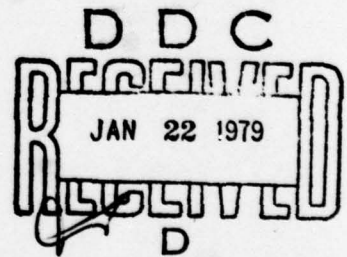
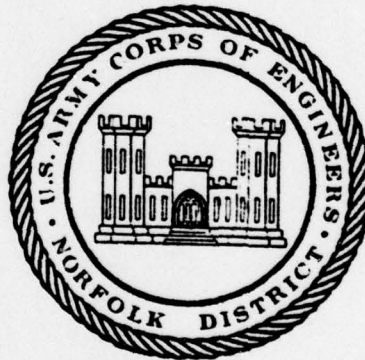
LEVEL II

①

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

AD A063501



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PREPARED FOR

**NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510**

BY

GILBERT ASSOCIATES, INC.

AUGUST, 1978

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

LEVEL II

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

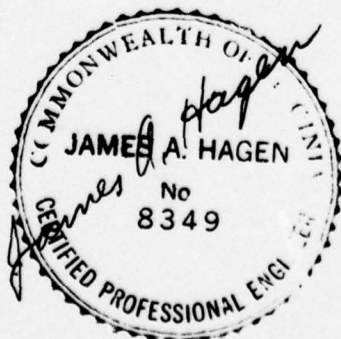
Name of Dam: Falls Mills
State: Virginia
County: Tazewell
USGS Quadrangle Sheet: Bramwell, W. Va. - Virginia
Stream: Mud Fork, Bluestone River

This dam is a 20-foot high, 445-foot long dam consisting of a 305-foot long ashlar masonry dam with a 140-foot earthen abutment. It has a 200-foot long uncontrolled overflow section which acts as the principal spillway. It has two 36-inch drain valves which are not operated. Based on the results of this inspection, the dam appears to require remedial measures due to deficiencies which could be hazardous depending on conditions. (See Appendix VI, Conditions)

The spillway capacity is inadequate and is not capable of passing one-half of the probable maximum flood (PMF) without overtopping of the earthen abutments. However, because of the vegetative growth, it is not likely that an overtopping of 0.7 feet for 6.0 hours during the one-half PMF occurrence will result in significant failure of the earth abutments. The spillway is capable of passing 35 percent of the PMF. It is recommended that during periods of unusually high runoff, the owner provide around-the-clock surveillance of the dam and have a warning system in the event of overtopping of the earth sections. The owner should make provisions in the future which would allow for safe passage of a larger flood at this site.

The masonry dam is apparently stable. However, adequate information is not available to evaluate its stability during the anticipated worst conditions of loading. Therefore, an investigation should be made within 6 months to determine the strength parameters of the dam masonry and the foundation rocks, and evaluate the factors of safety for stability of the dam. It is apparently not currently possible to operate the reservoir drains and lower the water level below the overflow elevation, because of sedimentation, and at least one of the valves should be made operable within the next year. There is excessive tree growth on the slopes of the abutments which should be removed and the slopes vegetated within 30 days. Because there is no program regular maintenance, it is recommended that one be prepared for this dam and its appurtenances within one year.

Prepared By:



APPROVED: Original signed by:

Douglas L. Haller
Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

20 AUG 1978

Date
8:11 PM '78

Original signed by:
JAMES A. WALSH

Original signed by:
ZANE M. GOODWIN
Recommended By:



June 1978

OVERVIEW PHOTO - FALLS MILLS DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: FALLS MILLS DAM I.D. NO.: VA 18503

SECTION I - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the U.S. Corps of Engineers, to initiate a national program of safety inspections of non-federal dams throughout the United States. The Norfolk District of the U.S. Corps of Engineers has been assigned the responsibility for supervising the inspection of dams in the Commonwealth of Virginia. Gilbert Associates, Inc. has entered into a contract with the Norfolk District to inspect this dam, Gilbert Work Order 06-7250-003.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Reference 1 of Appendix V) and contract requirements between Gilbert Associates, Inc. and the Corps of Engineers. The objectives are to expeditiously identify whether this dam apparently poses an immediate threat to human life or property and to recommend future studies and/or any obvious remedial actions that may be indicated by the inspection.

1.2 Project Description

1.2.1 Dam and Appurtenances: Falls Mills Dam is a 20-foot high, 445-foot long dam consisting of a 305-foot long ashlar masonry dam with a depressed 200-foot long principal spillway and a 140-foot long earthen fill abutment on its right side. The masonry portion contains two 36-inch diameter discharge pipes with gate valves.

1.2.2 Location: This dam is located about 0.7 miles west of Falls Mills, Virginia on the Mud Fork of the Bluestone River. See Location Map in Appendix I.

1.2.3 Size Classification: This dam is classified as a "small" structure based on its storage capacity of 990 acre-feet, in accordance with Section 2.1.1 of Reference 1 of Appendix V.

1.2.4 Hazard Classification: The dam is located upstream of a river valley. From the USGS quadrangle sheets, it appears that very few dwellings exist near the dam and it is therefore given a "significant" hazard classification in accordance with the guidelines contained in Section 2.1.2 of Reference 1 of Appendix V. The hazard classification used to

categorize dams is a function of location with respect to people and property only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by the Falls Mills Fishing Club. The President of the Club is Dr. G. Prescott of Princeton, West Virginia.

1.2.6 Purpose: Recreation. (According to a local resident, Mr. Bill Dixon, the dam was originally constructed as a water supply for the Norfolk and Western Railroad (N&W) but was never used for that purpose.)

1.2.7 Design and Construction History: There is apparently no available recorded data on the design and construction of this dam except for the three drawings in Appendix I. Those drawings indicate that the design and construction were done by personnel of the N&W or under their direction. The drawings also indicate the construction was done in two stages with the original dam constructed in 1908-1909 by Walton and Company and later raised 5 feet about 1912.

1.2.8 Normal Operational Procedure: There is no operation procedure for this dam according to Dr. Prescott, and any excess runoff flows freely over the spillway of the dam. The valves do not appear to be in operable condition.

1.3 Pertinent Data

1.3.1 Drainage Areas: The current drainage area of this dam is 17.8 square miles measured on the current USGS 7-1/2 minute quadrangle maps.

1.3.2 Discharge at Dam Site: The maximum flood of record at the dam site is not known. The discharge of the ungated spillway with the pool level at the top of the masonry dam is 3590 c.f.s. and 10,430 c.f.s. with the pool at the top of the earth embankment.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

Table 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet	Areas acres	Reservoir Capacity(a)		Length miles
			Acre feet	Watershed inch	
Top of Earth Abutment	2,332.0	105	990 ^(b)	1.04	-
Top of Masonry Dam	2,329.3	100	714 ^(b)	0.75	-
Ungated Spillway Crest	2,325.75	93.3	371.0	0.39	1.0
Steam at Elevation of Dam	2,310.00±	0	0	0	0

Notes:

- (a) Reservoir capacity is gross, no consideration was given to loss of storage capacity due to sedimentation
- (b) Extrapolated from two given points.

SECTION 2 - ENGINEERING DATA

2.1 Design: See drawings in Appendix I. No other data available.

2.2 Construction: Some material quantities and foundation conditions are given on the drawings in Appendix I. No other data are available.

2.3 Operation: There are no operational data.

2.4 Evaluation: The available information appears to be consistent with observed structures based on our visual inspection. There was no information on the materials or construction methods used for constructing the earth embankment on the right side of the dam. There is inadequate information available to evaluate this structure under all loading conditions.

SECTION 3 - VISUAL INSPECTION

3.1 Findings: This dam appears to be in good horizontal and vertical alignment. The masonry, including its joints, was apparently not significantly eroded. No significant downstream seepage was observed at either the masonry dam or its abutments; however, observations of some areas of the earthfill on the downstream right abutment were obstructed by the dense tree growth. The reservoir slopes were gentle and appeared to be stable.

There was excessive sedimentation in the reservoir to within about 2.6 feet of the spillway crest for its full length. The sediments were visible below water within about 5 feet (horizontally) of the spillway. The two 36-inch drain valves did not appear to be operable because of the silt buildup in the reservoir.

There was excessive tree growth on the slopes of both abutments.

3.2 Evaluation: The dam appears to require some remedial measures. The masonry appears to be in very good condition but the earthen portions of the right and the left abutments have excessive tree growth. The exposed abutment on the left appears to consist of competent rock. The reservoir appears to contain a large amount of sediment.

SECTION 4 - OPERATIONAL PROCEDURE

4.1 Procedures: None. Neither drain valve has been operated during recent history according to the owner's representative. Flow over the spillway is uncontrolled.

4.2 Maintenance of Dam: There are no maintenance records or program available for this dam.

4.3 Maintenance of Operation Facilities: None has been performed recently, according to the owner's representative.

4.4 Warning System: No formal warning system is in existence for this dam.

4.5 Evaluation: Periodic maintenance of the dam, including the earthen abutment, is not adequate. A warning system is recommended.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Other than the attached drawings no design data are available.

5.2 Hydrologic Records: None are available.

5.3 Flood Experience: None is available.

5.4 Flood Potential: Various flood hydrographs were routed through the reservoir. Results are described in paragraph 5.6.

5.5 Reservoir Regulation: Currently there is none. The drain valves on either side of the spillway are not operated and the flow over the spillway is uncontrolled.

5.6 Overtopping Potential: The PMF, one-half the PMF, and the 100-year flood hydrographs were developed for the Falls Mills Reservoir drainage basin and routed through the reservoir. The following table summarizes the results of this procedure:

Table 5.1 FALLS MILLS RESERVOIR FLOOD ROUTING

Item	Flood Hydrograph		
	PMF	1/2 PMF	100-Year
Peak Flow, c.f.s.			
Inflow	30,700	15,340	3,760
Outflow	30,300	15,150	3,600
Peak Elevation, feet m.s.l.	2,335.7	2,332.9	2,329.3
Ungated Spillway			
Depth of Flow, feet ^(a)	7.0	5.0	2.3
Average Velocity, f.p.s.	14.9	12.6	7.8
Overtopping of Stone Abutments			
Depth of Flow, feet ^(a)	4.5	2.4	-
Average Velocity, f.p.s.	12.1	8.6	-
Overtopping of Earth Abutment			
Depth of Flow, feet ^(a)	2.8	0.7	-
Average Velocity, f.p.s.	9.3	4.4	-
Duration, hours	11.0	6.0	-
Tailwater Elevation, feet	-	-	-

Notes:

 (a) Critical Depth.

The hydrographs were developed and routed by using the HEC-1 computer program (Reference 5 of Appendix V) and appropriate precipitation, unit hydrograph, and storage volume versus outflow data as input. The triangular unit hydrograph was developed from the drainage area and estimated time to peak (Reference 2 of Appendix V). Probable maximum precipitation and 100-year precipitation data were obtained from U.S. Weather Bureau publications (References 3 and 4 of Appendix V).

Information from record drawings was used to compute the storage-outflow relation. Losses were estimated at an initial loss of 1.0 inch and a constant loss rate of 0.30 inch/hour.

5.7 Reservoir Emptying Potential: The two 36-inch diameter gate valves, presently inoperative, would allow complete drawdown of the Falls Mills Reservoir if they were restored to operating condition.

Using those discharge pipes, it would take about 17 hours to drain water from the reservoir at a rate of about 342 c.f.s. at spillway crest elevation. The dam cannot now be emptied by the discharge pipes.

5.8 Evaluation: The results indicate that the Falls Mills spillway is not capable of passing one-half the PMF without overtopping the stone abutments and the earth abutment. However, it is not likely that 0.7 feet of overtopping resulting from one-half the PMF for 6.0 hours will result in significant failure of the embankment, based on the visual inspection. The 100-year flood raises the water surface up to the top of the stone abutments, which leaves approximately 3 feet of freeboard to the top of the earth abutment.

SECTION 6 - DAM STABILITY

6.1 Stability Analysis: No record of a previous stability analysis was available at the time of this inspection. As part of this report, a stability analysis was performed for this masonry dam. Some of the basic assumptions used for this analysis are indicated on the summary sheet in Appendix IV. The assumptions used included:

a. While a full horizontal hydrostatic load and silt load are used in computing overturning moments, only 50 percent of the hydrostatic head is used in computing uplift at the heel.

b. The design sediment level was 1 foot higher than measured during the inspection as an allowance for sedimentation buildup occurring over the next few years.

c. Tailwater forces were judged to be not significant.

d. Values for shear strength (2 KSF) and friction angle (37 degrees) at the masonry joint at elevation 2,310 feet are judgements.

6.2 Foundation and Abutments: The dam foundation consists of competent sandstone and blue slate (probably hard shale) rocks as given in the drawing, Appendix I. The rocks, as observed at the downstream toe, appeared to be strong and resistant to weathering.

The left abutment consists of sandstone and shale strata as shown on the drawing. The right abutment consists of the fill embankment resting on natural soil and rock strata (See drawings). The embankment slopes are 3 horizontal to 1 vertical and 2 horizontal to 1 vertical upstream and downstream, respectively. However, no information on the properties of the fill soils and the natural soils at the right abutment is available to evaluate the stability of the embankment.

6.3 Evaluation: Based on historic performance and the field inspection, the stability of the dam, its foundation, and the left abutment appears to have been adequate for previous loading conditions. No evaluation could be made for the stability of the fill embankment at the right abutment because of lack of the requisite information. However, no significant distress of the embankment was observed during the field inspection.

Information on constituent embankment soils and their properties (namely, gradation, permeability, density, and shear strength) as well as

those of the underlying natural soils and the soft shale underlying the masonry dam should be obtained.

The stability calculations performed for the masonry dam indicate the factor of safety for sliding is less than that recommended in Reference 7 of Appendix V and the resultant of overturning forces does not lie within the middle third of the dam as recommended in Section 4.4.4.4 of Reference 7 of Appendix V. These recommendations are for concrete gravity dams, however, it is our opinion that similar guidelines should apply to masonry dams.

The dam is located within Zone 2 on the Algermissen Seismic Risk Map of the United States (1969 edition) and there are uncertainties with respect to the static stability of the dam, as described in paragraph 6.3. Therefore, in accordance with paragraph 3.6.4 of Reference 1 of Appendix V, assessments should be made regarding seismic stability, based on the studies outlined in paragraph 7.2.2.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

The assessment, recommendations, and remedial measures contained in this report are based on the provisions of Appendix VI, Conditions.

7.1 Dam Assessment: On the basis of the field inspection, available drawings, and historic performance, the dam in its present condition does not show major and critical signs of distress such as displaced masonry units; severely eroded masonry joints; unanticipated settlement; or cracking, slope failures, or seepage at the abutments. However, several areas of concern regarding its future condition are:

7.1.1 The spillway capacity is inadequate in that the 140-foot long earthen abutment constructed of unknown materials will be overtopped by the one-half PMF. However, it is unlikely that overtopping for 6.0 hours will result in significant failure of earth abutments.

7.1.2 According to stability calculations performed, the ashlar masonry dam does not have an adequate factor of safety against either overturning or sliding.

7.1.3 The drain valves did not appear to be operable and therefore cannot be used to lower the reservoir elevation below the spillway crest during emergency conditions.

7.1.4 There is excessive tree growth on the upstream and downstream slopes of the abutments.

7.1.5 There is no program for regular maintenance on this dam according to the owner's representative.

7.2 Recommendations/Remedial Measures: The following measures are recommended because of the previously stated concerns:

7.2.1 During periods of unusually high runoff, the owner should provide around-the-clock surveillance and have a warning system in the event of overtopping of the earthen sections. The owner should make provisions in the future which would allow for safe passage of a larger flood at this site.

7.2.2 A study should be made within 6 months to determine the properties of the fill embankment and its foundation soils, as well as the soft shale, the strength parameters of the critical masonry joint, and methods of providing an adequate factor of safety against sliding and overturning. The results of such a study should be implemented soon after the study. It is suggested that the urgency would be determined during the

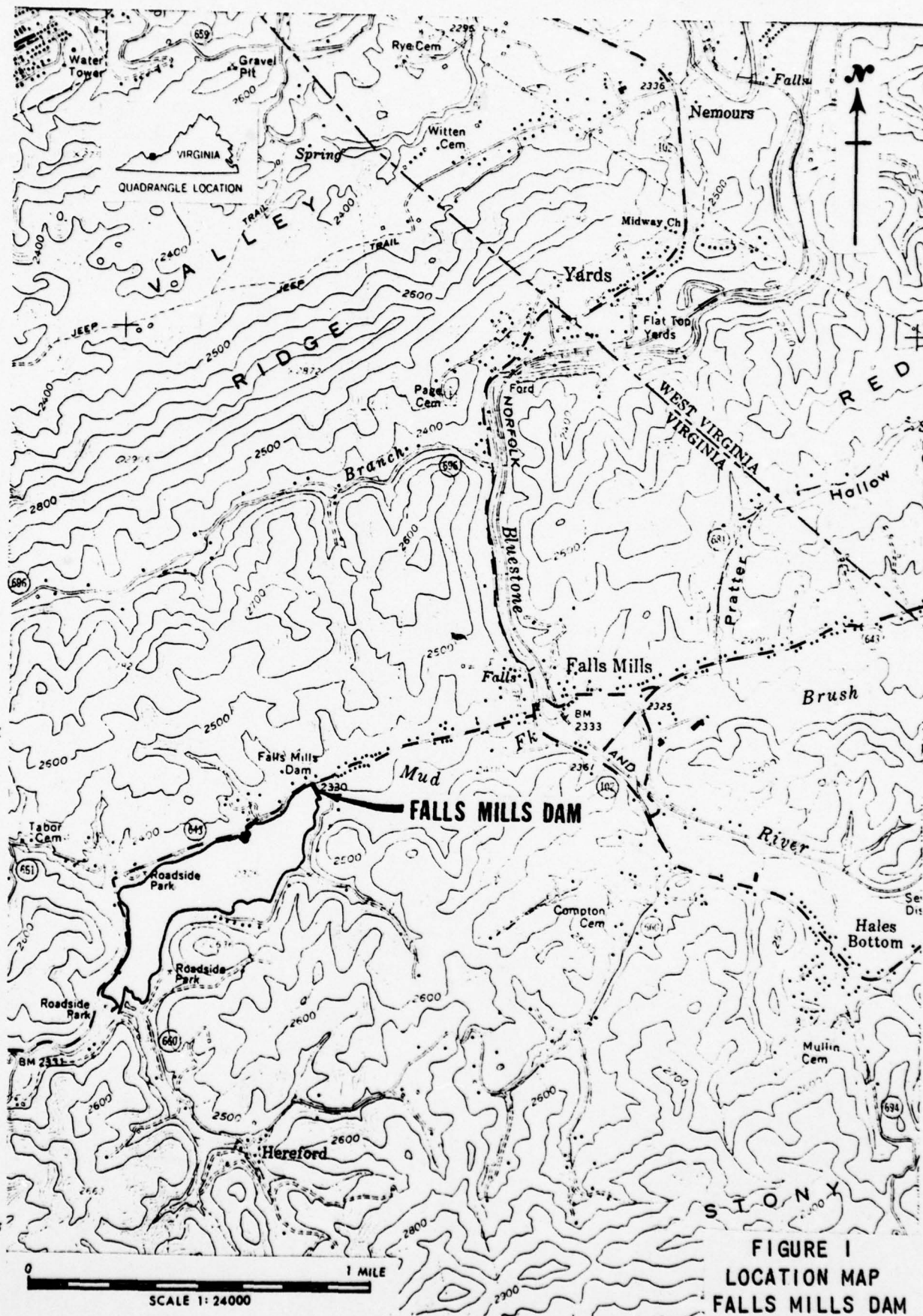
study, but in any case, measures should be implemented to provide the required factors of safety within one year.

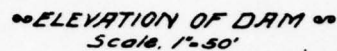
7.2.3 It is recommended that at least one of the drain valves be made operable within the next year. It is suggested that because of the depth of sediment, the southerly drain valve may be more effective in lowering the water level at the right abutment.

7.2.4 It is recommended that within 30 days the abutment slopes and the fill embankment be cleared of trees, grasses or other acceptable ground cover be established on the upstream and downstream slopes, and areas of disturbed riprap be repaired on the upstream slopes of the embankment.

7.2.5 It is recommended that within one year a program for regular maintenance be developed for this dam and the program instigated soon thereafter.

APPENDIX I
MAPS AND DRAWINGS



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∞ ELEVATION OF GATE VALVE ∞

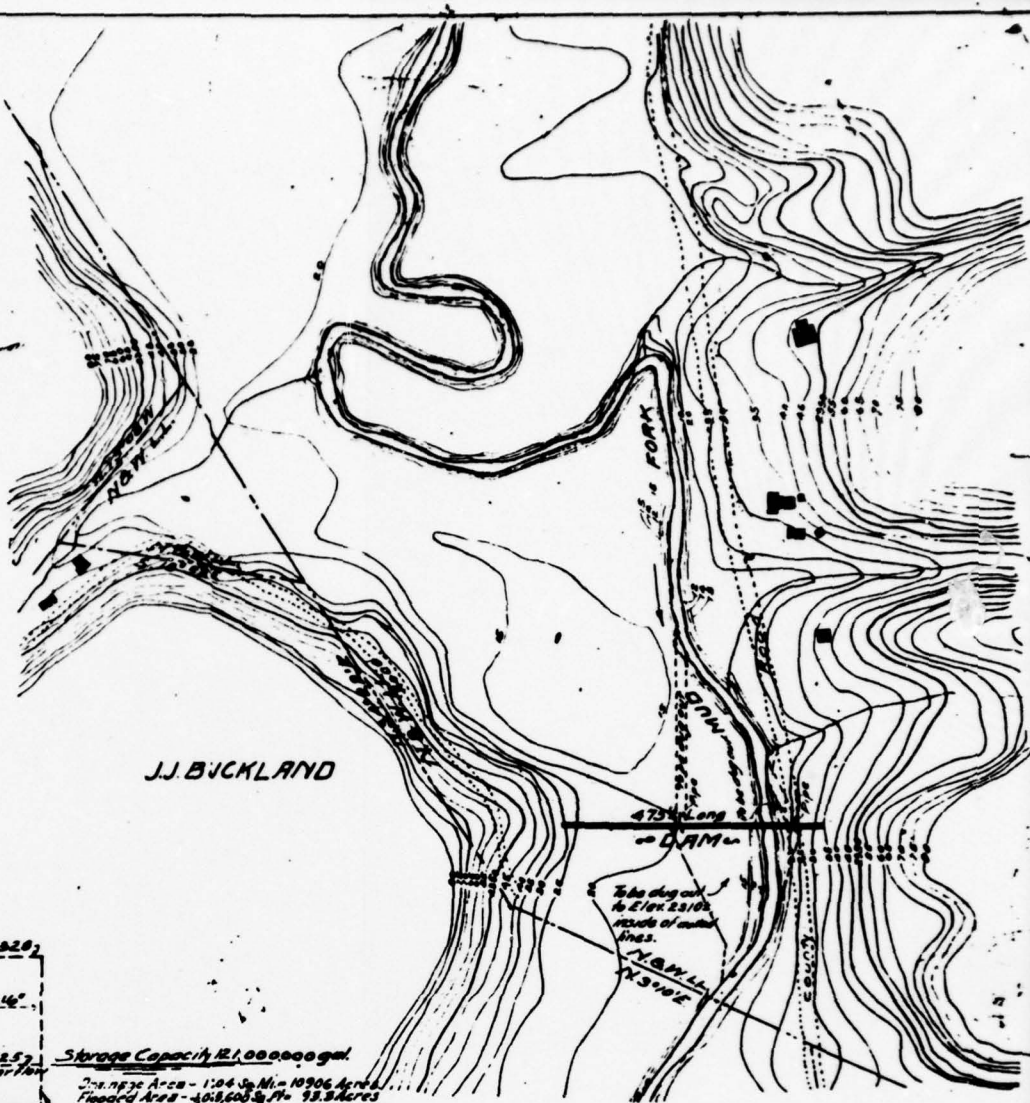
D-390. Gantt Chart Map

SECTION OF DAM-A

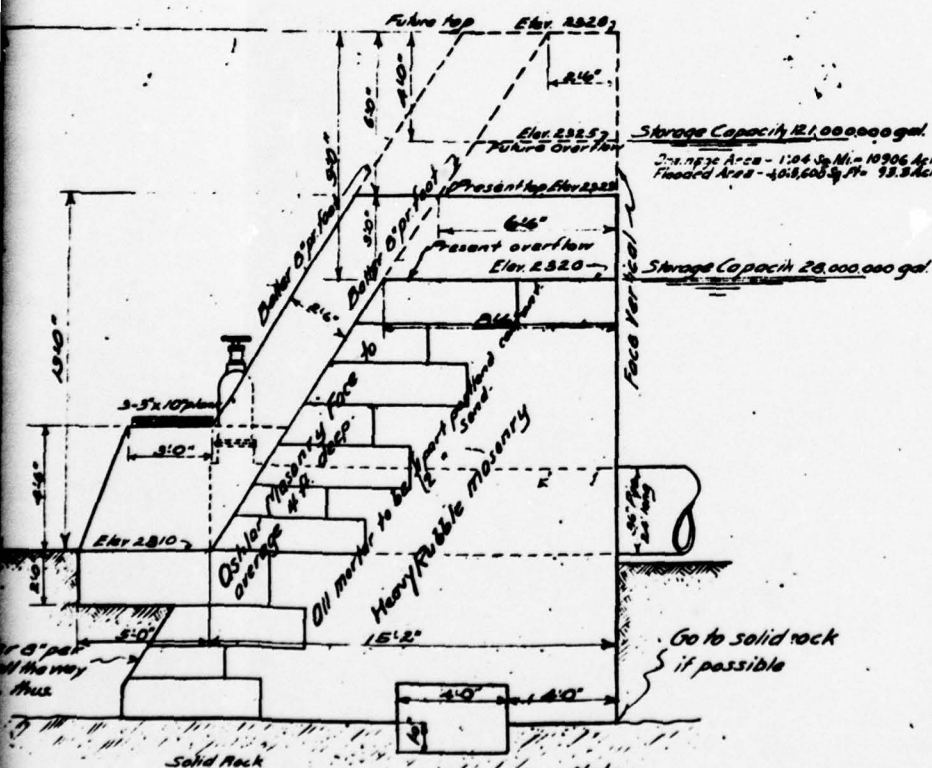
200'-0" overflow
 Elev 2328 Future overflow
 Elev 2328 Present
 Elev 2310
 Go to solid rock if possible
 One gate valve as per below detail

DAM

QUIT
 1912



J.J. BUCKLAND



Storage Capacity 121,000,000 gal
 Storage Area - 1:04 Sq. Mi. - 10,906 Acres
 Flooded Area - 4:08,600 Sq. Ft. - 93.8 Acres

Storage Capacity 28,000,000 gal

SITUATION PLAN
 Scale 1" = 200'

NORFOLK & WESTERN RY.

POCAHONTAS DIVISION

PROPOSED DAM ON

MUD FORK

Falls Mill

Scale 1" = 1'

Correct:-

Bridge Engr.

Approved: *[Signature]* Prin. Asst. Engr.

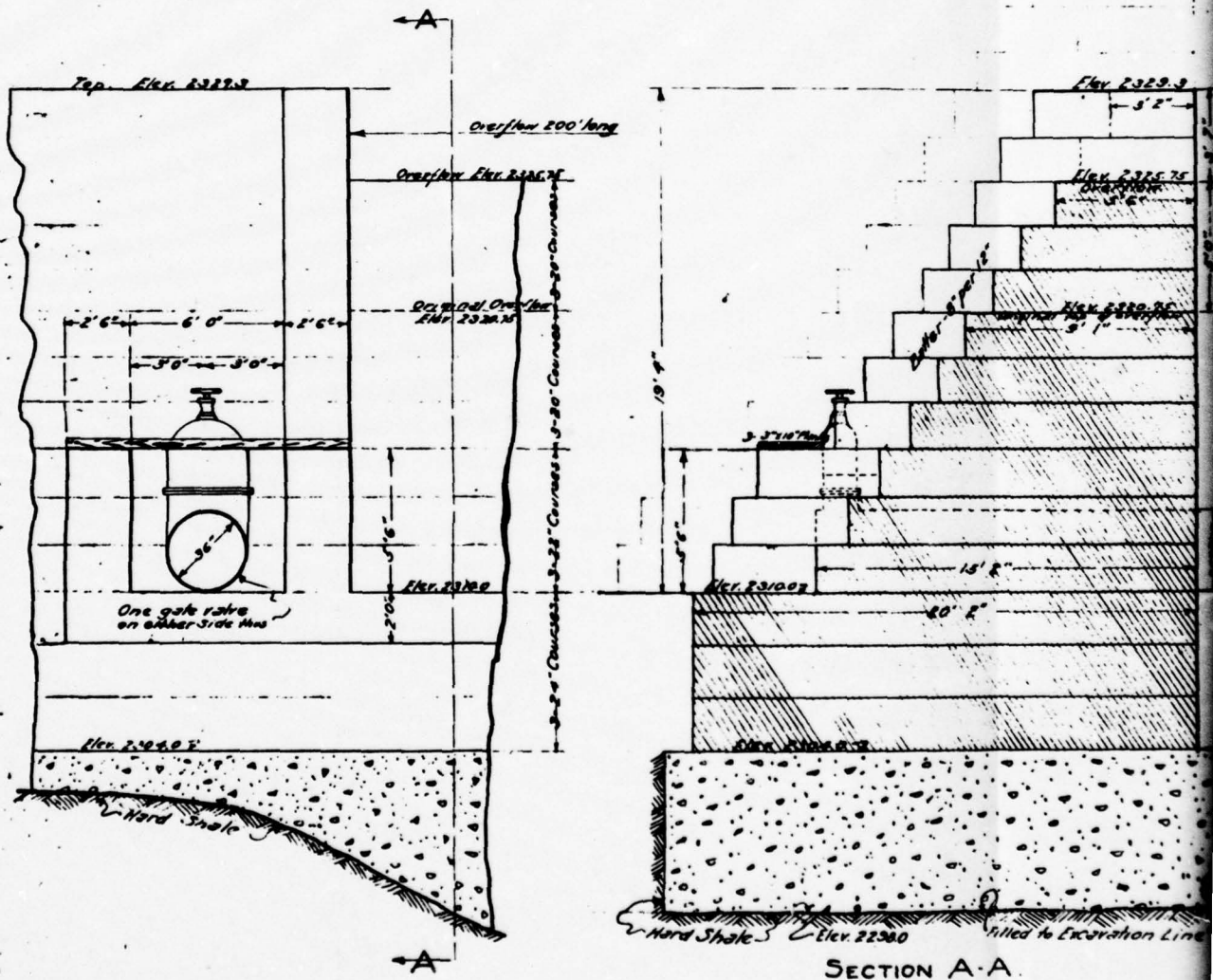
FIGURE 2

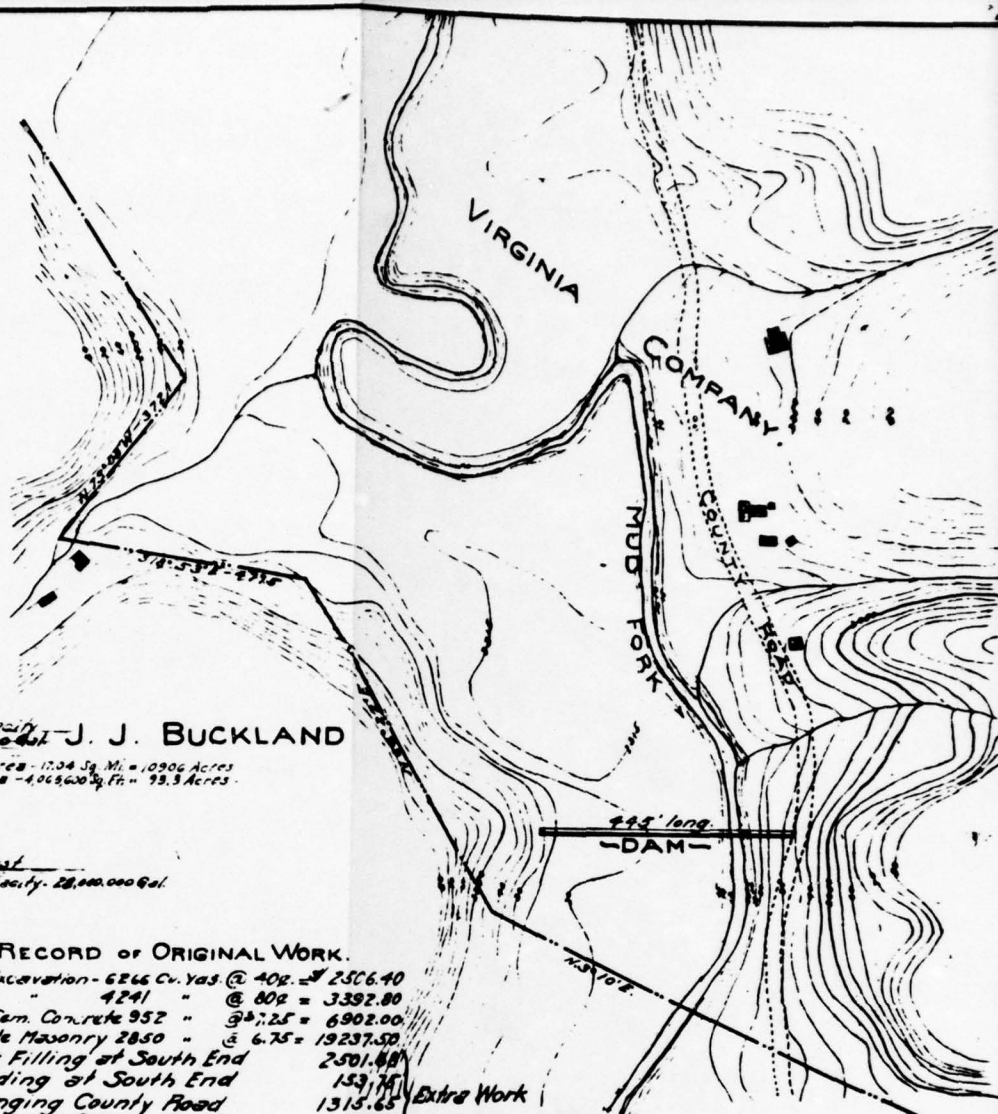
Office of Chief Engineer.
 Roanoke, Va Oct. 2-1908.

SECTION OF DAM - A-B

Note:-

Concrete, where used, to be Portland Cement, 1-2-4 mixture. Crusher to run stone that will pass thru 2" ring, all dust screened out.





Stages Capacity - J. J. BUCK
12,400,000 Gals.
Drainage Area - 17.04 Sq. Mi. = 10906 Acres.
Flooded Area - 4,069,600 Sq. Ft. = 93.3 Acres.

Original Cost _____
Storage Capacity. 28,000,000 Gal.

RECORD OF ORIGINAL WORK.

Dry Excavation - 6266 Cu. Yds. @ 40¢	2506.40	
Wet 4241 " @ 80¢	3392.80	
Port. Cem. Concrete 952 " @ 75¢	6902.00	
Rubble Masonry 2850 " @ 6.75¢	19237.50	
Back Filling at South End	2301.40	
Sodding at South End	153.75	
Changing County Road	1313.65	Extra Work
Clearing (above Dam)	264.82	
Total	\$36274.80	

Walton & Co. - Contractors.

Work Commenced Nov. 1st. 1908
Work Completed July 20th. 1909

• SITUATION PLAN •
SCALE - 1" = 200'

PLAN OF DAM
ON

- MUD FORK -

RECORD OF RAISING DAM 5 FT.

Master Masonry - Main Body of Dome 319.64 G.M.
 " " - South A buttress Wings 4.13 " FAZEWELL CO. VA.
 " " - North " 10.35 "
 Total 334.12 " SCALE-1"=4'

SCALE-1"=4'

Concrete - 3 Abutment Walls : 26.00 "

" - Under Wing Wall Extn's : 6.50 "

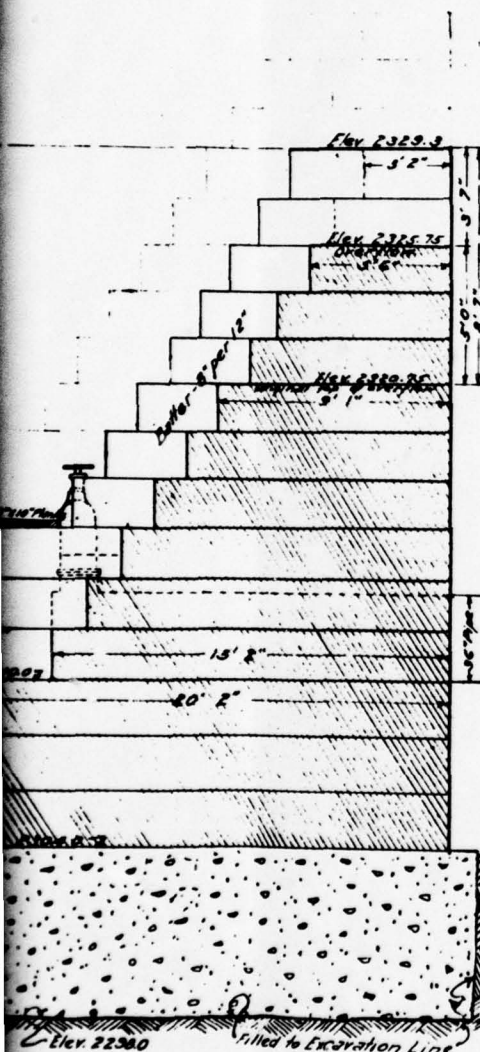
" - Toe Wall : 32.50 "

" - Slab Paving : 18.50 "

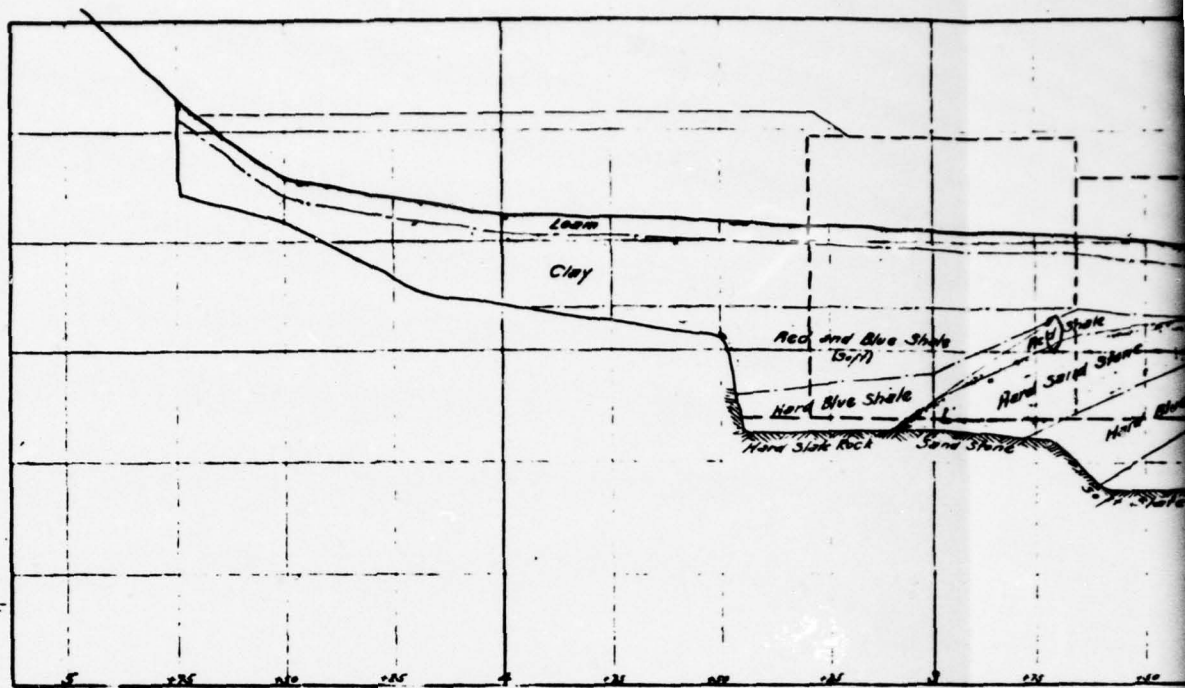
FIGURE 3

FALLS MILLS

Office of Chief Engineer.
Roanoke Va Jan 19th 1918

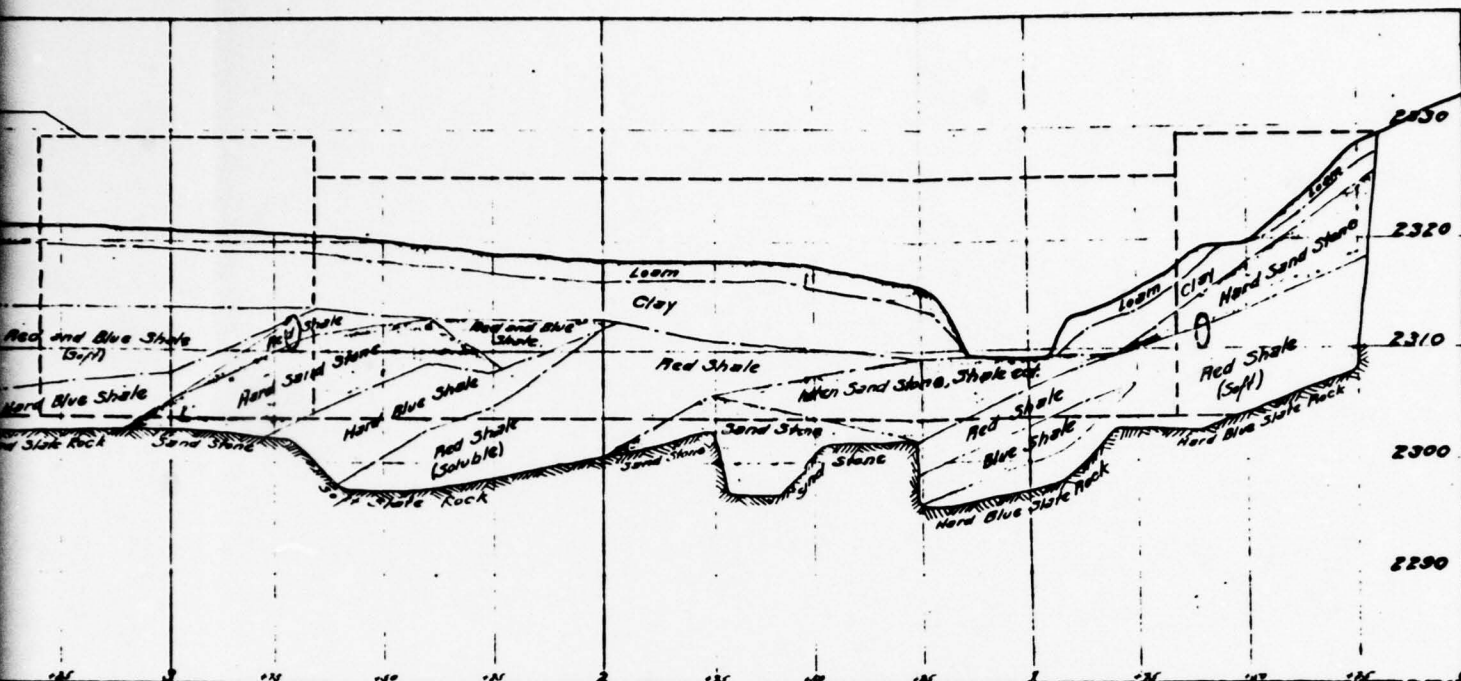


SECTION A-A



CROSS-SECTION of FOU
 See Y-3634 for Mason
 Scales { Hor. 1" = 25
 Ver. 1" = 10





CROSS-SECTION of FOUNDATION.

See Y. 36344 for Masonry

Scales { Hor. 1" = 25'
Ver. 1" = 10'

FIGURE 4
FALLS MILL

Office of Chief Engineer
Roanoke Va Jan 19th 1912

APPENDIX II

PHOTOGRAPHS



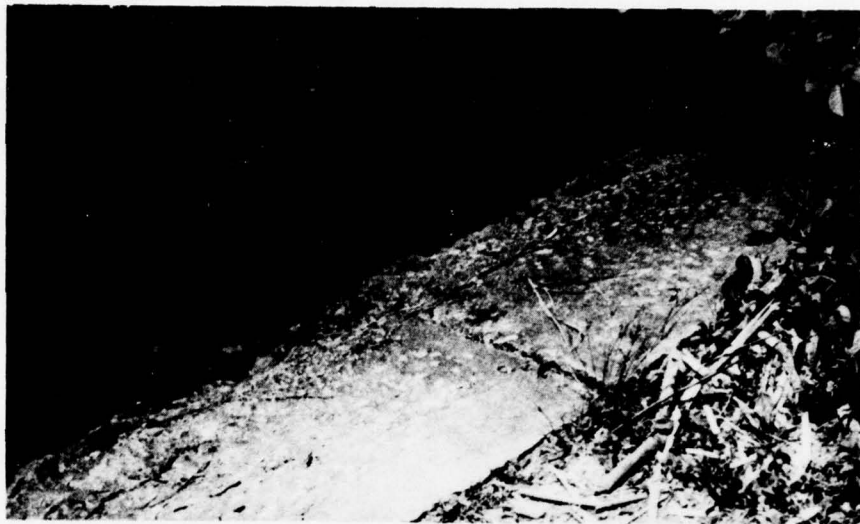
June 1978

VIEW FROM RIGHT ABUTMENT OF TOP OF FILL EMBANKMENT



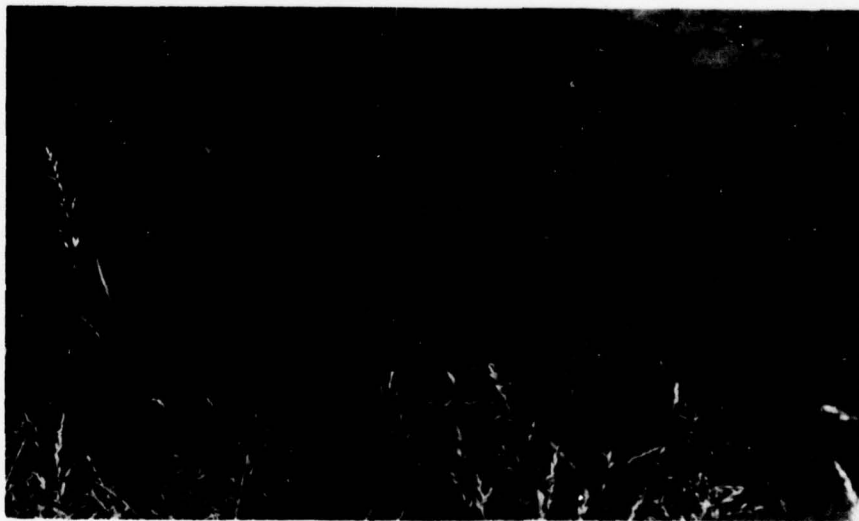
June 1978

DETAIL OF DISCHARGE VALVE



June 1978

RESERVOIR SLOPE PAVING - NEAR CENTER OF FILL EMBANKMENT



June 1978

CLOUDY DEPRESSION NEAR SHORE ON LEFT SIDE
OF DAM AND 150 FEET UPSTREAM

NOTE: PROBABLY SEDIMENT COVERED CULVERT DISCHARGING
INTO RESERVOIR



June 1978

VIEW FROM LEFT ABUTMENT



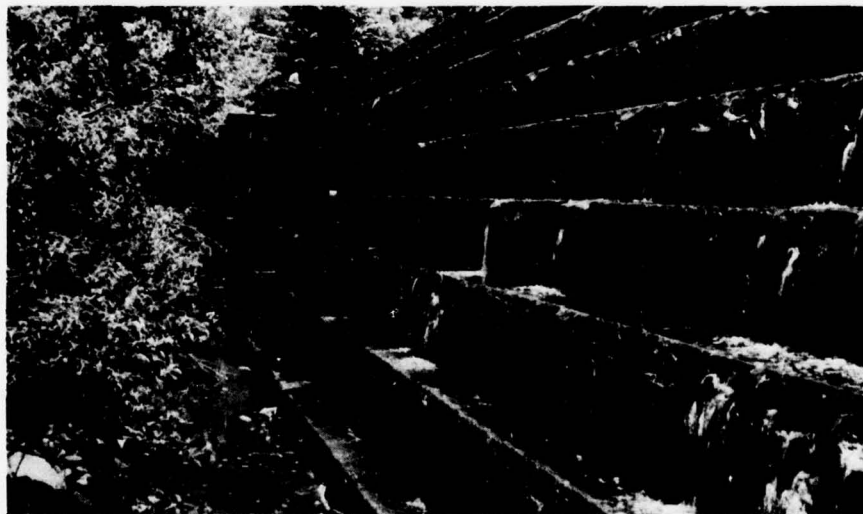
June 1978

VIEW FROM RIGHT ABUTMENT
NOTE: TOP WIDTH OF DAM



June 1978

DOWNSTREAM CHANNEL AT TOE OF DAM



June 1978

DETAIL OF DOWNSTREAM FACE

NOTE: EXCELLENT ALIGNMENT OF MASONRY

ALSO NOTE EXCESSIVE TREE GROWTH ON DISTANT EARTHFILL SECTION

APPENDIX III
FIELD OBSERVATIONS

APPENDIX III
FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam: Falls Mills County: Tazewell State: Virginia Coordinators: Norfolk District Corps of Engineers

Date(s) Inspection: June 15, 1978 Weather: Clear Temperature: 82°F

Pool Elevation at Time of Inspection: 2326 feet m.s.l. Tailwater at Time of Inspection: 2310± m.s.l.

Gilbert Associates, Inc.

Inspection Personnel:

Nazir A. Qureshi
James A. Hagen
Yogesh S. Shah

Others Present:

Buck Arnold - Virginia State Water Control Board
Duncan MacGregor - U.S. Soil Conservation Service
Dr. Gordon Prescott - President, Falls Mills Fishing Club

James A. Hagen - Recorder

CONCRETE/MASONRY DAMS

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	None observed at the dam-abutment junction at downstream left. No foundation underseepage was suspected. Because of dense vegetation, seepage at the dam-abutment at right or downstream of the fill embankment, if any, could not be seen. However, no significant seepage is suspected there. No leak through the dam was observed.	Heavy siltation of the reservoir in the vicinity of the dam may have reduced the seepage.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Except for some tree growth on the left abutment and heavy vegetative growth at the right abutment, the junctions showed no apparent signs of distress.	The trees at the left abutment should be removed. The vegetation on the right side must be cleared of trees and bushes.
DRAINS	None observed.	
WATER PASSAGES	Not applicable.	
FOUNDATION	No unusual foundation behavior is apparent. The exposed shale and sandstone rocks at the toe appeared hard and appeared to have good resistance to weathering.	None.

CONCRETE/MASONRY DAMS

Sheet 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	None visible.	None.
STRUCTURAL CRACKING	None visible.	None.
VERTICAL AND HORIZONTAL ALIGNMENT	Good	None.
MONOLITH JOINTS	None. The masonry joints did not appear to be significantly deteriorated.	
CONSTRUCTION JOINTS	None visible, but the joint made during the 1912 dam raising showed no signs of distress.	None.

EMBANKMENT

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed. None visible on the downstream slope because of dense vegetation; none suspected.	The surface of the dam should be cleared of trees and large bushes to enable closer observation of its condition.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Apparently none.	See recommendation above.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.	
VERTICAL AND HORIZONTAL	Vertical and horizontal alignments could not be verified because of the vegetation.	None.
RIPRAP FAILURES	Some shoreline surface lining failure seen near the right abutment. A section of the shoreline protection appeared to consist of masonry units similar to those used in the dam construction.	Lining must be repaired.

EMBANKMENT

Sheet 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junction with dam and natural ground were not properly visible for inspection because of vegetation.	The area must be cleared of large bushes and trees for closer examination.
ANY NOTICEABLE SEEPAGE	None observed; but, significant seepage is not suspected because a significant flow of water was not noticed going to the downstream channel from the abutment areas.	None.
STAFF GAGE AND RECORDER	None.	
DRAINS	None visible.	

OUTLET WORKS

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None.	
INTAKE STRUCTURE	None.	
OUTLET STRUCTURE	None.	
OUTLET CHANNEL	None.	
EMERGENCY GATE	Two 36-inch gate valves, one on either side of the spillway, are presently inoperative.	At least one should be made operable to provide for reservoir drawdown.

UNGATED SPILLWAY

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The ashlar masonry weir was apparently in good condition.	
APPROACH CHANNEL	Silted to within 2-1/2 feet of the crest of the spillway.	None.
DISCHARGE CHANNEL	Rocky and wooded. Slopes are stable. Silty deposits on rocks and trees and erosion of lower 3 to 4 feet of slope areas indicated recent tailwater buildup possibly resulting partially from a bridge several hundred feet downstream.	None.
BRIDGE AND PIERS	None across the spillway.	None.

INSTRUMENTATION

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None observed.	
OTHER	None observed.	

RESERVOIR

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Densely wooded without any visible exposed areas.	None.
SEDIMENTATION	Observations from the shoreline and the dam indicated there is heavy siltation to within 2.6 feet of the overflow elevation.	Sediments are blocking the 36-inch drain pipes, and increasing the horizontal loading on the dam.

DOWNSTREAM CHANNEL

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Some fallen trees, rock pieces, a small bridge approximately 200 feet downstream of the dam.	None.
SLOPES	Rocky, tree covered and stable with regard to large failures.	None.
APPROXIMATE NO. OF HOMES AND POPULATION	The 1962 Bramwell, W. Va. - Va. quadrangle indicates nine buildings (including a church) below contour 2320 between the dam and where the stream enters the Bluestone River. This would correspond to a population of about 36 people.	None.

APPENDIX IV
STABILITY ANALYSIS

GRAVITY DAM DESIGN STABILITY ANALYSIS

ANALYSIS DONE ON — FULL SECTION ☒ PARTIAL SECTION
LOCATION OF SECTION — Falls Mills Dam Spillway
ANALYSIS PREPARED BY — D.C. Beechwood

Revised May 20 8/10/78

LOADING CASE	ELEV. HEAD WATER	ELEV. TAIL WATER	ΣV	ΣH	$\frac{\Sigma H}{\Sigma V}$	LOCATION RESULTANT FROM TOE	% BASE IN COMPRESSION	FACTOR SAFETY SLIDING	FOUNDATION PRESSURE	
									TOE	HEEL
PMF	2334.7	—	18.0 K/FT	18.3 K/FT	1.02	3.09 FT	61 %	2.40	3.88 KSF	0.
$\frac{1}{2}$ PMF	2332.3	—	18.6	15.4	0.83	4.74	94 %	2.88	2.62	0.
Normal Water Load + ICE	2325.75	—	20.1	14.5	0.72	3.49	69 %	3.14	3.84	0.



PARTIAL SECTION

NOTES: 50% UPLIFT USED FOR ANALYSIS
FOR SLIDING ANALYSIS $\phi = 37^\circ$
 $S = 2.0$ KSF

APPENDIX V

REFERENCES

APPENDIX V
REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, (Washington, D.C., Department of the Army, Office of the Chief of Engineers).
2. Design of Small Dams, U.S. Department of the Interior, Bureau of Reclamation, Second Edition, 1973.
3. "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian," U.S. Weather Bureau, Hydrometeorological Report No. 33, April 1956.
4. "Rainfall Frequency Atlas of the United States," U.S. Weather Bureau, Technical Paper No. 40, May 1961.
5. "HEC-1 Flood Hydrograph Package," Hydrologic Engineering Center, U.S. Army Corps of Engineers, January 1973.
6. Reviews of Spillway Adequacy - E.T.L. No. 1110-2-234, (Washington, D.C., Department of the Army, Office of the Chief of Engineers), 10 May 1978.
7. Gravity Dam Design Stability - E.T.L. No. 110-2-184, (Washington, D.C., Department of the Army, Office of the Chief of Engineers), 25 February 1974.

APPENDIX VI

CONDITIONS

APPENDIX VI

CONDITIONS

This Report is based on a visual inspection of the dam, a review of available engineering data, and a hydrologic analysis performed during a Phase I investigation as set forth in the U.S. Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams and the contract between the U.S. Corps of Engineers and Gilbert Associates, Inc.

The foregoing inspection, review, and analysis are by their nature limited in scope. It is possible that conditions exist which are hazardous, or which might in time develop into safety hazards, that are not detectable by this inspection, review, and analysis. Accordingly, Gilbert Associates, Inc. cannot and does not warrant or represent that conditions which are hazardous, or which may in time develop into safety hazards, do not exist.